On isogeometric yield envelopes

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ABSTRACT

In numerical analysis the failure of engineering materials is controlled through specifying yield envelopes (or surfaces) that bound the allowable stress in the material. Simple examples include the prismatic von Mises (circle) and Tresca (hexagon) yield surfaces. However, each surface is distinct and requires a specific equation describing the shape of the surface to be formulated in each case. These equations impact on the numerical implementation (specifically relating to stress integration) of the models and therefore a separate algorithm must be constructed for each model.
This paper presents, for the first time, a way to construct yield surfaces using techniques from isogeometric analysis [1], such that different yield surfaces can be represented within the same framework. These isogeometric surfaces are combined with an implicit backward-Euler-type stress integration algorithm [2] to provide a flexible numerical framework for computational plasticity. The numerical performance of the algorithm is demonstrated using both material point investigations and boundary value analyses.

References

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[2] M. Wilkins, Calculation of elastic-plastic flow, in S Fernback & M Rotenberg (eds.), Methods of *Computational Physics*, **3**, Academic Press, N.Y., 1964.